Abstract: In this thesis we introduce, implement and compare several multivariate goodness-of-fit tests. First of all, we will focus on universal multivariate tests that do not place any assumptions on parametric families of null distributions. Thereafter, we will be concerned with testing of multivariate normality and, by using Monte Carlo simulations, we will compare power of five different tests of bivariate normality against several alternatives. Then we describe multivariate skew-normal distribution and propose a new test of multivariate skew-normality based on empirical moment generating functions. In the final analysis, we compare its power with other tests of multivariate skew-normality.